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**A constant travel time budget?  
In search for explanations for an  
increase in average travel**

**Research Memorandum 2002-31**

Faculteit der Economische Wetenschappen  
en Bedrijfskunde (FEW)

Vrije Universiteit

Amsterdam



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**Bert van Wee  
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## Abstract

Recent research suggests that during the past decades the **average** travel **time** of the Dutch population has probably increased. **However**, different data sources show different **levels** of increase. Possible **causes** of the increase in **average** travel **time** are presented here. Increased incomes have probably resulted in an increase in both **costs** and **benefits** of travel. The increase in travel **time** **may** **also** be due to **benefits** **having** increased more rapidly than **costs**. Costs **may** even have decreased due to the increased comfort **level** of **cars** and increased opportunities offered to make double use of one's **time** (e.g. working in a train).

## 1. Introduction

During the past three decades a discussion has been going in the literature **about** the question if people on **average** have a more **or** less constant travel **time** budget. Researchers **who** conclude so are, among others, **Szalai et al. (1972)**, Zahavi (1979) and Shafer and **Victor** (1997). In recent years several Dutch authors have done research on this subject and discussed the hypotheses of constant travel **time** budgets (see, for example, Goudappel Coffeng, 2001; Kraan, 1996; Muconsult, 1997, 2001; Peters **et al.**, 2001; Rietveld, 1999; SCP, 1999; Van Goeverden, 1999). The theme is important because constancy of travel **time** implies that neither long run developments **such** as technological change and **economic** growth, nor transportation **policies** have a notable impact on total transport volumes. Changes in the composition and **spatial** patterns **may** of course be substantial, but the total volumes would remain unaltered. In particular the constancy of travel **time** would imply **that** the development of **faster** modes would lead to **longer** travel distances.

**The objective** of this paper is **to** establish developments in **time** use in The Netherlands over the past 25 years using available data sources. Subsequently, hypotheses **will** be discussed which **might** explain the trends found in the data.

**Section 2** describes and **discusses** the development in **average** travel **time** using the two data sets of the CBS as mentioned above. **Section 3** presents **categories** of explanations for constant travel **time** budgets as presented in Peters **et al.** (2001). In **section 4** possible explanations for the increase in travel **times** are discussed. **Section 5** gives a **general** overview of our **findings, discusses** them and **presents** suggestions for **further** research.

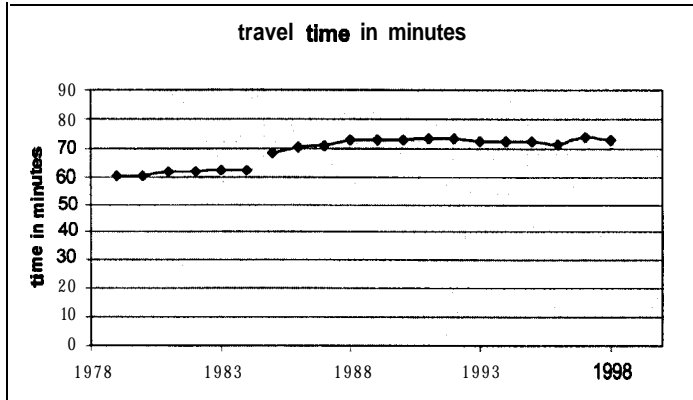
## 2. A overview of data

In The Netherlands two data sources **exist to** investigate trends in **time use** for transport: The **National** Travel Survey (OVG) and the **Time** Use Survey (TBO).

The OVG is a cross-sectional survey conducted by **Statistics** Netherlands (CBS) **continuously every** year since 1978. The sampling unit is **the** household. Sample **sizes** increased **from** 10,000 in the periode 1978-1995 **to** 60,000 households **from** 1995

onwards. Data on travel are **collected** using travel diaries. The design of this survey **changed** in 1985 and 1995, implying that trends over a **longer** period are subject to trend breaches. This is a serious limitation, which **can** only be partially **corrected**. In 1999 a new design was **introduced**. Data **from** 1999 onwards are not used in this **paper**.

Figure 1 shows the developments in **time** used per day for travel for **persons** aged 12 or older



Source: CBS, National Travel Survey (OVG, various years)

*Fig 1: Average time used for travel per person per day, travel survey data*

The figure shows a trend breach for 1984. The figure is analysed using two trend regressions, for the period 1979-1984 and for 1985-1998. Results **indicate** that between 1979 and 1984 **time** used for travel did **indeed** increase with 2.1 minutes. Between 1985 and 1998 travel **time** increased with 2.8 minutes. Hence, in total **travel**

time increased between 1979 and 1998 with 4.9 minutes, correcting for the trend breach. Hence, this suggests that total travel time increased since 1979 with about 8%.

The Time Use Survey (data have been collected by SCP) presents a picture of the use of time in The Netherlands. The survey started in 1975 and has been repeated every five years. About 3,000 respondents keep a diary for a week in which they note what they have been doing. The survey is not comparable with the OVG-survey, hence the results on time use for travel will be different. Specifically, time use is measured in 15-minutes intervals. Hence, the respondents will not register short trips. Table 1 shows the results

Table 1: Time use for travel from the Dutch Time Use Suwey @er person per week andper day )

	1975	1980	1985	1990	1995	2000
Hours per week	6.6	6.8	7.1	7.9	8.5	8.4
Minutes per day	56.6	58.3	60.9	67.7	72.8	72.0

Source: SCP, Time Use Survey (TBO, various years)

Travel time increased, accordingly to the Time Use Survey with about 15 minutes per day from 1975 to 2000. This is an increase of about 26% from 1975 to 2000. The difference between the outcomes for the two data sources (an increase of 8% versus 26%) can be explained partly because OVG covers a shorter period (8% for 20 years implies about 10% for 25 years). Another explanation is that if total travel time per day increases it will demonstrate itself probably more clearly in the time use data than in the travel survey data. The reason is that when short trips take clearly less than 15 minutes they will remain underreported in the time use data. An increase in the travel time for all trips would imply that the probability of tmderreporting of short trips decreases. This would lead to a more than proportional increase in total reported travel time. For a turther discussion of travel time data issues see Rietveld (2002).



We conclude that although the two sources differ in terms of the magnitude of the increase in travel **time**, they are in agreement that it increased during the past decades.

### 3. Explanations for constant travel **time** budgets

Based on an extensive literature review, including literature from economics, psychology, biology, sociology and other disciplines Peters et al. (2001) present three **categories** of explanations for constant travel **time** budgets,

#### *Reductionistic explanations*

Reductionistic approaches use more or less absolute explanations for **human** behaviour and related constant travel **time** budgets. Examples **can** be found in biology, zoology, socio-biology, experimental psychology and evolutionary psychology. For example, evolutionary psychology assumes that most of **human** behaviour has a **genetic** background. That background **may also** explain travel behaviour. The **genetic structure** results from a long evolutionary development. The explanations for constant travel **time** budgets **can** be found in a homeostatic regulatory system, in a need for a minimum level of exercise to stimulate **muscles**, and in a complex system of hormones related to the **costs** of travel (discomfort, stress, energy **use**) and benefits (the **access** to destinations, the pleasure of cycling, driving a **car** or travelling by train) and in biological **clocks**.

#### *Reconstructive explanations*

**Reconstructive** approaches explain **human** behaviour in mathematical ways (quantitative **models**) based on theoretical pre-assumptions on behaviour. Examples **can** be found in disciplines that describe **human** behaviour in terms of utility (as **can** be found in economics, psychology, geography). The assumption is that **human** behaviour results **from (economic)** rational behaviour: it is the **result** of choices between different options. Explanations **result from** an **optimal** balance between **time** for activities and for related travel (Atijst, 1995; Bhat and Koppelman, 1999) and **from** the marginal disutility of extra travel **time** or additional trips compared to the marginal **benefits** of related activities (e.g. a job at a bigger distance **from** home might increase the utility of working).

### *Contextualising explanations*

These approaches explain **human** behaviour **from** a **historic**, cultural, **socio-psychological**, **social** or geographical perspective. Examples **can** be **found** in history, psychology, geography and **cultural** anthropology. According to these strategies a constant travel **time** **can** not **be** explained by individual behaviour. It is the context in which an individual functions that explains travel behaviour. Evolutionary learning **processes** might explain travel **time** budgets.

In our opinion the **first** type of explanations, the reductionistic explanations, give little opportunities to explain the possible increase in travel **time**: the increase **conflicts** with these explanations. In **principle** the third category, contextualising explanations might be helpful to explain an increase in travel **times**, but during the period 1975-2000 in our society **changes** have been too limited to explain the increase in travel **time** by this category of explanations. Therefore the reconstructing strategies are the most **helpful** to explain the increase in **average** travel **time**: the increase might **result from** (a) an increase in **benefits** of travel, (b) a decrease in **costs**, or (c) a change in the composition of population, e.g. with respect to age and **income**. In this article we adopt these **three categories** of possible explanations and **discuss** them.

## 4. Possible **causes** for an increase in **average travel time**

In this **section** we present *possible causes* of the increase in travel **times**. Further research is needed to find **out** if they really play a role (see **section 5**).

### 4.1 A possible increase in the **utility** of travel

According to the **reconstructive** explanations an increase in the utility of travel **results** – ceteris **paribus** – in an increase in travel **times**. Possible reasons why this utility might have increased are presented below.

#### *Spatial trends*

Due to spatial trends the utility of extra travel **time** might have increased. Relevant trends are increases of the **scale** at which services are available. E.g. in health **care** and

hospitals the number of services have decreased and the **average size** of remaining services have increased (SCP, 1996) Therefore people need to travel more to **reach** the same service. **Also** the locations of jobs related to employees have **changed**: recently developed employment **areas** are relatively **often** located at the **outskirts** of town. The **size** of cities and towns have increased, resulting in bigger distances between new residential **areas** and town centres. Therefore, for the same utility people have to travel more.

#### *Specialisation on the labour market and of the **skills** of employers*

The labour market is specialising more and more. The same **holds** for employees. The educational level of employees has increased as **well** as the education **level** required for **many** jobs. **Many** jobs require specialised education and training. These trends imply that nowadays a **person** searching for a new job has to search in a **much** bigger search area to select 5 possible jobs than some decades ago. Again, the utility of traveling **longer** distances increases (see for example Rietveld and van Woudenberg, 2002).

#### *Segmentation in the housing market*

Due to **higher income levels** people's aspirations with respect to housing (**both** dwellings and the residential environment) have increased. Preferences probably have become more **specific** ('a **pre-war** house in a **nice**, green environment that is **attractive** for children'). Therefore the search area of households might have increased. This **process may** further be stimulated by the **decreased** level of **social** relationships at the neighbourhood or **village** level. The **chance** that people **find** an **attractive** dwelling close to their job location has decreased. This trend **may** further be strengthened by the relatively homogeneous way in which in the Netherlands **post-war** residential **areas** have been designed. Due to the increased search area for dwellings travel **times** to locations **of jobs**, relatives, **friends** etc. **may** have increased.

#### *A diversification of **leisure** activities*

Within the same overall **time** for leisure people tend to **participate** in more **leisure** activities. The general wish for more diversification in leisure explains this trend, but **also** the **desire** to **participate** in more expensive leisure activities made possible by the

increased incomes (Batenburg and Knulst, 1993). This trend results in an increase of leisure related travel **time**.

#### *Travel for the fun of it*

People partly travel for the fun of it (Mokhtarian and Salomon, 1999). Research shows that the **time** spent for fun travel increases. Examples are Sunday touring by bike, motorcycle and the **car** (Batenburg and Knulst, 1993).

#### *Other economic developments*

Like most **countries** the Netherlands has become a service society. The transition **from** an agricultural and industrial to a service society results in an increasing need for face-to-face **contacts** and possibly an increase in business travel. Only part of these **needs can** be fulfilled by ICT. Secondly the trend of increasing *outsourcing* of **non-core** business probably results in the spatial separation of **core** activities and suppliers and therefore in an increase of related mobility.

### 4.2 The changing costs of travel

The **second** category of possible explanations for an increase of **average** travel **time** might be the changing costs of travel. In this **section** we present some explanations of this type.

#### *The increase in the share of car kilometres of motorways*

The road **network** is relatively safe and **comfortable**. The **chance** per kilometre of getting killed in a road accident on a motorway, is only one third to 11% of that **chance** on other **categories** of **roads** outside the built-up area (Koornsta, 1998): The share of **car** kilometres on the **express-way** network has increased during the past decades, at the expense of the share of kilometres in the built-up area (CBS, 2001). The impact on **average** travel **time** per **person** per day is difficult to **predict** because it has two **effects** with a different sign. On the one hand generalised transport costs per km **will** have decreased due to the **higher** safety and comfort level, resulting in more travel. On the other hand generalised transport costs *per hour* have increased because the speeds on the motorways are **much higher** than **average**. Therefore people drive more kilometres per hour and have **higher** monetary costs. Further research is needed

to conclude what the impact is of the increase in the share of the motorways on travel **time** budgets.

#### *A reduction in the improvements of the road network*

In the past two decades, as in **many** other countries (**such** as Britain) the improvements in the road network have been limited compared to the previous decades (V&W, 1999; CEMT, 1999). We not only refer to new motorways and other major roads outside the built-up **areas** but **also** to major roads within the built-up **areas**. However, **car** use and **car** ownership have **continued** to increase during the past decades. Besides, the utility of **longer** travel distances has probably increased, for several reasons as presented in this paper. Possibly the improvements in the road **infrastructure** have not been able to **cope** with the increased **level** of **car** use, with an increase of congestion as a **result** (see CEMT, 1999). For given combinations of origins and destinations travel **times** probably have increased. Because the travel **times** increase slowly and in a **rather** smooth way people might get used to the increases and accept them, and therefore not consider a change of jobs **or** residential location. **or** of other destinations.

This trend of increased travel **times** for given combinations and destinations seems to conflict with the overall increase in speeds of travel at the road **network**, but it does not. Despite the increase of congestion, speeds at the motorways **still** are **much higher** than on other roads. In the Netherlands on a yearly basis about 10% over travel **time** at the **main** roads is lost due to congestion. This **means** that  $\text{— assuming an average travel speed of } 100 \text{ km/h without congestion — the average travel speed including congestion still is } 90 \text{ km/h}$ . And this, of course, is **much higher** than the **average** for **all** roads. Therefore the increase in the share of kilometres at the **main** road network has resulted in an increase of **average** speed for **all car** kilometres at the complete road network, despite the strong increase in congestion in the past two decades (Van Wee and Van den Brink, 1999).

#### *The role of the bicycle*

The share of the bike decreases rapidly at distances **longer** than 5 and certainly 10 km. E.g. only few people cycle to their work if the home-to-work distance is more **than** 10 km. Probably the disutility of cycling increases more than proportional at **longer**

distances. This might be explained by physiological **factors**. Assuming **the** trend towards bigger distances and **the** increased level of **car** ownership more people **can reach** destinations at further distances by changing their modal choice **from** the bicycle to the **car**. But **once** they use the **car**, the more than proportional disutility **after** 5 to 10 kilometres does not exist anymore, or at least to a lesser extent. This is especially true because at **longer car** distances the share of kilometres on the relatively comfortable and safe motorway increases. The overall effect **may** be a lower disutility of **longer** travel **times**.

#### *The increased level of comfort of cars*

Nowadays **cars** are **much** more comfortable than some decades ago. **Bennis et al.** (1991) developed a quality index for **cars**. Between 1962 and 1990 the index for 'comparable **cars**' increased by 30%. This increase results in a decrease of the disutility of travel by **car**. Besides, **many** people consider **travelling** by **car** as more comfortable compared to travelling by public transport or the bicycle. The increased level of **car** ownership **makes** comfortable travel by **car** available for more people. Besides, **cars** have become **much** safer, **also** leading to a decrease of the disutility of travel (see **also** below). Finally, the reliability of **cars** has improved, **making** the use of them more **attractive**. In short, the **better** quality of **cars** has resulted in a decrease of the disutility of using them.

#### *Improved road safety*

The risk of getting killed in a road accident has rapidly decreased. Despite the increase in mobility nowadays the number of people killed in road traffic is only one third of the **level** in the early seventies (CBS, 1995). This is not only **caused** by the increased safety of **cars**, as mentioned before, but **also** by improvements in **road infrastructure** and health **care** (including the **time** an ambulance **needs** to **reach** the location of a road accident and to return to a hospital). Safer travel **means** a lower disutility of it.

#### *Increased possibilities to combine travel with other activities*

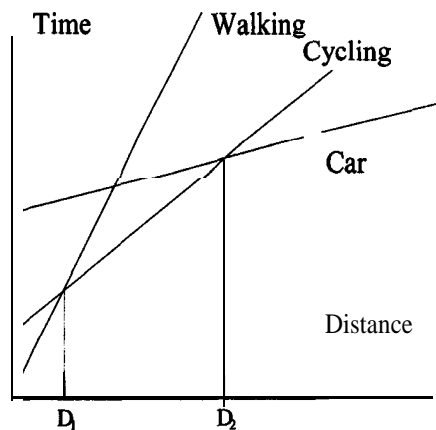
Possibilities to combine travel with other activities have increased. E.g. one **can** work in a train by using a portable computer. And people **can** make phone calls both in

trains as well as in cars. The increased possibilities to combine travel with other activities have resulted in a decrease of the disutility of travel time.

#### 4.3 An analysis of changes in costs and utility

In this section we present a simple model to demonstrate the impact of the changes in costs and utility on average travel time. The model shows the choices of persons under changes in costs and utility of travel on the one hand, and the resulting travel time on the other hand. We assume a person chooses between three modes: walking, the bicycle and the car. We start analysing (changes in) costs. Figure 1 visualises the travel times for trips for each mode.

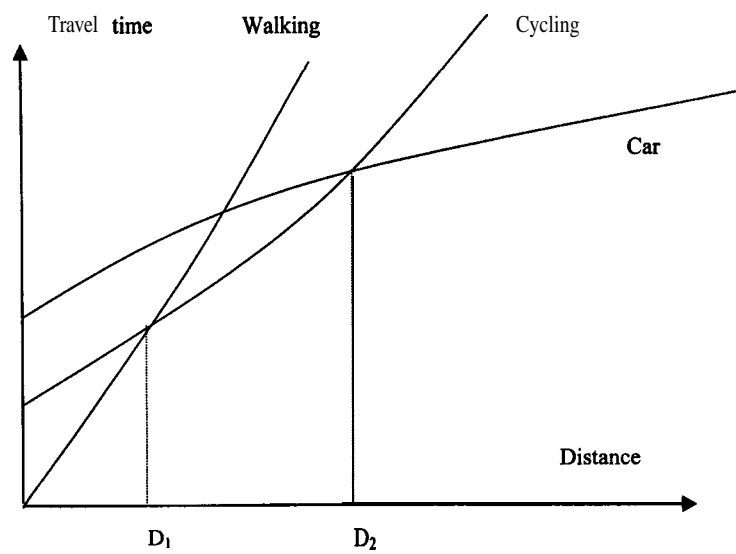
Figure 1: travel times per model; a linear relationship between travel distance and travel time



We firstly assume constant speeds with respect to distance. Because using a car means one has to spend time to walk from home to the car (parking place), get into it and start it, the car is less attractive for very short distances. The same holds for the bicycle, but to a lesser extent. However, in practice travel speeds are not constant. For people walking or cycling the average speed will decrease as distances increase because they need time to rest. For the car average speed will increase, because the

share of the motorway increases as distances increase. Note that only with **very** long trips (**after** a few hours) a **car driver** has to rest. In the rest of this article we do not assume resting **time** for **car** users. Figure 2 visualises the **result**.

Figure 2: *travel times per mode assuming non-constant speeds.*



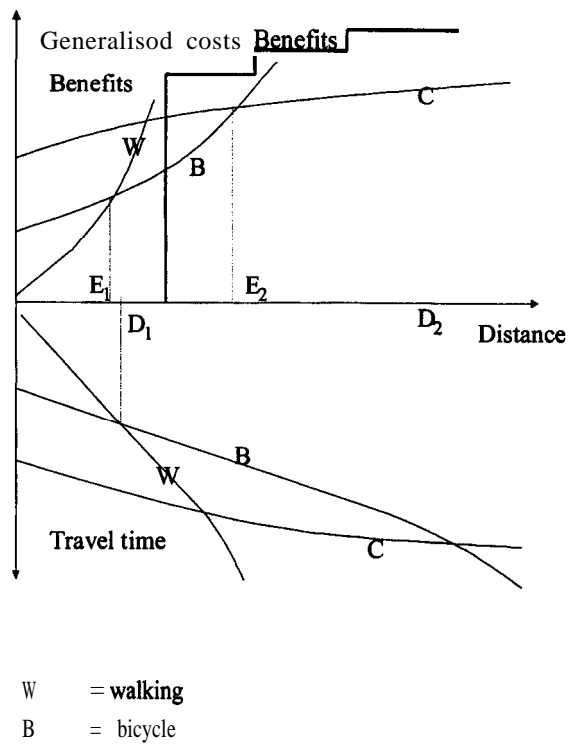
If the choice of the **person** would only be based on distance the **areas** per mode would be defined by **D<sub>1</sub>** en **D<sub>2</sub>**.

Generalised transport costs not only **depend** on travel **time** only and the **valuation** of it. The **car** is more **comfortable** compared to the bicycle, especially in case of bad weather, and for **longer** trips. **Many** people **like** cycling for a **short** period, e.g. 10 minutes, but not for, for example, one hour. Besides, **social** and physical safety have impact on generalised transport costs as monetary **cost** (hke **fuel** costs, parking costs and tolls) do. Figure 3 visualises the possible level of generalised transport costs as a function of travel for different travel **times**. It is **clear** that the **areas** for **each** mode as defined by Et and **E<sub>2</sub>** will differ **from** the **areas** defined by **D<sub>1</sub>** and **D<sub>2</sub>** as **presented** in



Figure 2, the **result** being that **an** increase in distance does not necessarily **result** in **an** increase in travel **time**. To illustrate this we assume the **shift from** the bicycle to the **car**. Only based on travel **time** this **shift may** occur at a distance of **—** for example **• 3** km. A **person who** dislikes cycling **may** switch at 1.5 km, someone **who likes** cycling only at 5 km. In other words: if the distance increases from 4.5 to 5.5 kilometres the **latter person will** switch from the bike to the **car**. Although the distance increases, travel **time** decreases. This example shows that discontinuities might occur: **longer** distances **can** be **combined** with shorter travel **times**. The more generalised transport costs are dominated by travel **time** the lower this effect. Note that this effect only occurs due to a **shift** of modes. (We do not consider here a decrease in **car** travel **time** due to a change of routes **after an** increase in distance, e.g. due to choosing the relatively fast motorway for **longer** trips).

Figure 3: generalised costs, *benefits* and travel *time* per mode, by *distance*



C =car

A change of modes **may also result** in an increase in travel **time**. Consider an individual that dislikes cycling. An increase of travel distance **from** 1.4 to 1.6 km results in a **shift** from the bicycle to the **car** and to an increase of travel **time**. **The same occurs often** if a **person shifts** from the **car** to public transport.

Not only the costs but **also** the benefits play a role. Let us assume the trip to a shop for daily **needs**. Consider a **person who** lives near an **average** quality shop within cycling distance and there are more remote, high quality shops. The line showing the benefits is the stepped line as presented in Figure 3. Note that shops at bigger distances with lower quality are not relevant and therefore excluded in Figure 3. The curve of benefits **can** be found by sorting shops by distance and then excluding shops with a lower or equal quality compared to nearer shops. The preferred shop is the one with the **biggest difference** between costs and **benefits**. **The** utility of visiting this shop is expressed as the **vertical difference** between both the **cost** and the **benefit** curve. In the case of Figure 3 it is the shop **accessible** by bike. **It** is possible that for **all** possible locations, costs exceed benefits. Then the **person will** not make the trip. It is **clear that** the form of the curve of benefits depends on **specific** circumstances: the location of the household and the locations of services in its surroundings. Nevertheless, the model **can** be used in qualitative terms to demonstrate the **effects** of **changes** in benefits and costs on travel **times**. We now **can** link the possible explanations for increased travel **times** as presented in sections 4.1 and 4.2 to the model. We start with the explanations as presented in **section** 4.1

**Spatial trends such** as the increases in the **scale** of services imply that nearby services disappear. The supply curve only becomes positive at **longer** distances. It is **clear** that this **results in longer** trips and (apart **from** the rare exceptions due to **longer** travel **times after** switching modes) to **longer** travel **times**. *Specialisation on the labour market and of the **skills** of employers* **also** lead to a decrease of opportunities at shorter distances. The curve of **benefits will shift** to the right. The same **holds** for the *segmentation ut the **housing** market*. The developments with respect to leisure and the trends in **economy** (the transition to services, more outaourcing) **result** in the same

pattern: **an** increase in the utility of travel and therefore **an** increase in travel **time**. The increase in travel **time** due to **an** increase in travel for the **fun** of it is evident.

**Factors** with respect to the costs as presented in **section 3.2**, the **role** of the bicycle, **the** increased comfort **level** and safety of **cars** and the increased possibilities to combine travel with other activities, **result** in lower costs. The reduction in generalised transport costs increases the **chance** that people **will chose** more remote opportunities. Besides, trips with **higher** costs than **benefits** (for **all** opportunities and related distances) **will** not be made without the reduction in generalised transport **costs**. But due to the decrease in these costs benefits might exceed the costs, resulting in more trips and therefore more **time** for travel.

We conclude that the model as presented in Figure 3 offers possibilities to analyse **changes** in the costs and benefits of trips, and the resulting travel **time**.

An important trend that **deserves** more attention is **the** increase in incomes. This trend has a complex impact on Figure 3. Firstly, **an** increase in income results in **an** increase **in car** use, **making longer** trips relatively more **attractive**. These **longer** trips do not necessarily **result** in more travel **time** because, generally speaking, the **car** is **faster** than the bicycle **or** public transport. On the other hand, people with **higher** incomes have a **higher** value of **time** (Gunn, 2001). On **average** they **also** have more expensive **cars**, resulting in **higher** monetary costs. **Higher** incomes therefore **result** in **an** upward effect on the **cost** curve. **This** upward effect is not the same at **all** distances. On **average** the optimal travel distance, and so travel **time**, **will** decrease due to the increase of generalised transport costs. On the other hand, **benefits** of opportunities **will also** vary with income. People with **higher** incomes **will** be prepared to **pay** more for the same opportunities. Therefore not only the **cost** curve **will** show **an** upward trend due to **higher** incomes, but **also** the **benefit** curve. It is difficult to say beforehand what the impact on the optimal travel **time** and distance **will** be. For opportunities of which the benefits increase more than generalised transport **costs**, **an** increase in travel **times will** be the **result**. In the opposite case a decrease **will** occur. We give **an** example of the **first** possibility. Assume the **value** of **time** increases proportional with income and monetary costs increase less than proportionally with income. In that case generalised transport costs increase less than proportional with income. If the

preference for variety increases proportionally with income the **benefit curve will** increase more than the curve of the generalised transport **costs**. **Longer** travel distances **will result**, and **very likely also longer travel times**. It is **also** relevant that due to the **higher** incomes the **car** gets more comfortable, resulting in a lower value of **time**. People with **higher** incomes **can** therefore decrease the disutility of travel and make the increase in the **cost** curve less than by **shifting** to more comfortable **cars**. We conclude that the effect of an increase in incomes on travel **time** depends on **many factors** and **can** be both positive and negative.

One relevant aspect has been excluded so far. Due to an increase in the utility of travel and the related increase in travel **time**, **time will** get more scarce leading to an increase in the value if it. Figure 3 only assumes separate trips without paying attention to impact on **the time** budget for **other** activities. The inclusion of relationships between trips **will** make **final** changes in travel **times** less than Figure 3 assumes.

#### 4.4 Changes in the population

##### *Changes in the share of 'homogeneous groups of people'*

**Average** travel **time** differs between 'homogeneous' groups of people (e.g. with respect to age, income and household situation). Therefore a change in the **break-down** of population **may** lead to an increase in **average time spent** on travel. Goudappel Coffeng (2001) made a break down of the population with respect to one variable (**gender**, age, household **structure**, the number of **cars** in the household, education, employment situation and urbanisation) using **TBO** data. The results show that for **each** disaggregated group the increase in travel **time** is more **or** less the same as for the **whole** population. Theoretically it is possible that a breakdown **based on** more than one variable gives other results, but this is not **very** likely. Our **first** conclusion is that changes in the population with respect to variables **such** as age and education do not explain the increase in **average** travel **times** of the **whole** Dutch population.

##### *More people combining different tasks*

Another change with respect to population **may** be relevant: an increase in the proportion of people combining tasks **such** as taking **care** of children and working.

E.g. between 1975 and 1995 in the Netherlands the number of **working** females increased by **80%**, whereas the increase in the number of working **males** was **less** than 10% (AW, 1997). It is possible that the increase in the share of people combining tasks leads to an increase in **average** travel **time**. **However**, research by Batenburg and Knulst (1993) shows that this increase did not significantly **contribute** to the increase of **average** travel **time**.

#### *A decrease in household size*

Since the sixties the **average** household **size** decreased. This decrease **may** lead to an increase in mobility because per **person** the **time** needed for household **related** tasks, **such** as shopping, increases (Batenburg and Knulst, 1993).

### 5. Discussion and suggestions for further research

The above explorations suggest that the possible increase in travel **time** mainly is the **result** of the increased **utility** of **longer** trips (**longer** expressed in travel **time**) and **changes** in the transport system. Changes in the population probably hardly play a role. We suggest that in the past decades benefits of **longer** trips have increased and **costs** of travel have decreased, the **result** being an increase in **average** travel **time** of the Dutch population. The reduction in travel **costs** might explain why empirical research shows a decrease in the value of **time** in the Netherlands in the past decade, despite the increase in incomes (Gunn, 2001).

We suggest **future** research into travel **time** budgets with respect to next **subjects**:

1. Research into the **subjects** as **discussed** in this article. Important **aspects** may be:

- Spatial trends
- Specialisation on the labour market
- The reduction in the speed of improvements in the road network
- **The** increase of comfort and safety **level** of **cars**
- The increase in possibilities to combine travel with other activities

- The increase in the share of motorways in travel **time** and kilometres
2. Research into 'utility **based**' indicators for **accessibility** (see, for example **Geurs** and **Ritsema van Eck**, 2001). These indicators explicitly **pay** attention to the utility of travel for a **person**. They assume decreasing marginal utility of additional opportunities. E.g. the expected **difference** between one and two supermarkets within a **walking** distance of two minutes is bigger than the expected **difference** between 5 and 6 supermarkets at this distance. Using these indicators it is possible to **find out** if changes in the land-use and **the** transport system, and in the population **or** the preferences of the population **will result** in changes in the choice of opportunities, travel distances and travel **times**.
  3. Panel data research focusing on the question if people get used to slowly increasing travel **times** between given combinations of origins and destinations. Results **from** psychology, assuming that people are less sensitive for gradual but steady changes than for discontinuous changes that are equally large, **can** be used. Another subject for panel data research **may** be changes in the lifestyles **leading** to an increased utility of visiting unique **places, where** a **person** has not been before.
  4. Research into the effect of the increase of ICT use on travel behaviour, both with respect to travel **time** as **well** as with respect to changes in activity patterns.
  5. Historical research into travel behaviour in the past century and the impact of the **factors** as described in this article on it. Along **similar** lines cross country studies **will** shed light on the present theme.

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